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INFORMAL REPORT

OCEANOGRAPHIC CRUISE SUMMARY BAFFIN BAY-DAVIS STRAIT-LABRADOR SEA

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INFORMAL REPORT

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ABSTRACT

This report describes the oceanographic survey conducted in the autumn of 1966 in the Baffin Bay-Labrador Sea area aboard the Canadian Coast Guard Ship LABRADOR. The survey was performed to obtain knowledge of the ocean environment for use in the annual East Arctic Ice Forecast Program.

A cursory analysis of these data shows that considerable penetration of Atlantic Water into Baffin Bay had taken place at the time the survey was conducted. No other significant variations in the water column were observed.

Two survey devices were field tested and evaluated. A Bergen Nautik subsurface wire angle indicator was used successfully and is recommended for oceanographic operations. A multiple thermometer frame caused pretripping of the Bergen Nautik sample bottle. Further evaluation should be made of this device on future surveys.

This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Report.

L. B. BERTHOLF
Director, Nearshore Surveys Division

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I. PREVIOUS KNOWLEDGE OF THE REGION

The ice forecast stations in the Baffin Bay-Davis Strait-Labrador Sea area have been occupied for a number of years in connection with the East Arctic Ice Forecast Program. Since 1964, ice forecast observations have been obtained through a Canadian-United States cooperative program.

The survey area is separated into three general areas: Baffin Basin, Davis Strait, and Labrador Sea. The Baffin Basin, according to previous surveys conducted by Naval Oceanographic Office (NAVOCEANO) personnel and literature on the area, has been described as having water with temperatures less than 1°C to -0.4°C and salinities of approximately 34.5‰.

The Davis Strait area, according to Defant in 1942, has Baffin Land Current water (less than -1°C) along the western side of the strait with its core at about 100 meters; Atlantic Water at 400 meters (salinity of approximately 34.5‰) midway between Canada and Greenland; and warmer weakly saline West Greenland Current water on the eastern side of the strait.

The Labrator Sea area, according to Defant, has Atlantic Water with cold Labrador Current water flowing southward along the shelf off the Labrador coast.

II. OBJECTIVES OF THE SURVEY

Objectives of the survey were to obtain serial depth, temperature and salinity observations at the designated ice forecast stations listed in Table I. In addition, trace metal water samples were to be collected.

Table I
POSITIONS FOR THE ICE FORECASTING STATIONS

Latitude °N	Longitude °W	Latitude °N	Longitude °W
53.0	55.0	69.0	59.5
55.0	57.0	70.0	56.0
57.0	57.0	70.6	60.0
58.0	60.0	71.6	69.0
59.0	57.0	71.7	65.0
60.5	63.0	73.2	63.5
61.0	49.0	75.6	77.5
62.0	64.0	75.7	70.0
62.8	57.0	75.7	64.2
64.5	57.0	75.7	59.2
65.6	60.0	77.1	76.2
66.3	59.0	78.0	74.5
66.8	55.0		

III. NARRATIVE OF THE SURVEY

Ice forecast survey (Project 202-02) was conducted aboard Canadian Coast Guard Ship LABRADOR as a cooperative program with Bedford Institute of Oceanography, Dartmouth, N.S., Canada.

LABRADOR departed Thule, Greenland, 29 September 1966. The Bedford Institute scientists proceeded to take magnetic observations along the ship's track using a sensor type proton precision magnetometer. These data were recorded on punch tape, and NAVOCEANO scientists assisted in monitoring this recording system. NAVOCEANO scientists, assisted by Bedford Institute scientists, obtained serial oceanographic data at 24 of the 25 ice forecast stations. LABRADOR arrived at Dartmouth, on 17 October 1966. The cruise track and oceanographic station locations are shown in Figure 1.

IV. RESULTS

On this survey, 24 oceanographic stations were occupied yielding 333 serial measurements of temperature, salinity, and depth. One designated station (61°N 49°W) was not occupied. Sixteen BT lowerings were made, and one bottom sample was obtained. A total of 100 trace metal samples was collected. In addition, a Bergen Nautik subsurface wire angle indicator and a multiple thermometer frame were evaluated.

Table II presents a summary of data collected on the 24 oceanographic stations.

V. METHODS OF COLLECTION AND ANALYSIS

A. Physical Oceanography.

1. Temperature. Deep sea reversing thermometers were employed at standard oceanographic depths. Protected thermometers with a range of -2° to 20°C or -2° to 10°C were paired on each Bergen Nautik bottle. Agreement between temperature readings of the paired thermometers averaged $\pm$.02°C, or better.

2. Depth. Meter wheel readings, surface and subsurface wire angle measurements, and thermometric depths were used to obtain sampling depths. Unprotected thermometers with a range of -2° to 30°C or -2° to 60°C were utilized at depths greater than 200 meters. Thermometric depth calculations were made by the method described in U.S. Navy Hydrographic Office Publications 607 and 614. An experimental multiple thermometer frame was used on the deepest bottle of the cast in an effort to compare several unprotected thermometers at one depth. The additional weight of the frame and thermometers caused the Bergen Nautik bottle to pretrip; therefore, use of the frame was discontinued after the fourth station. Subsurface wire angle measurements were made 28 times with a Bergen Nautik wire angle

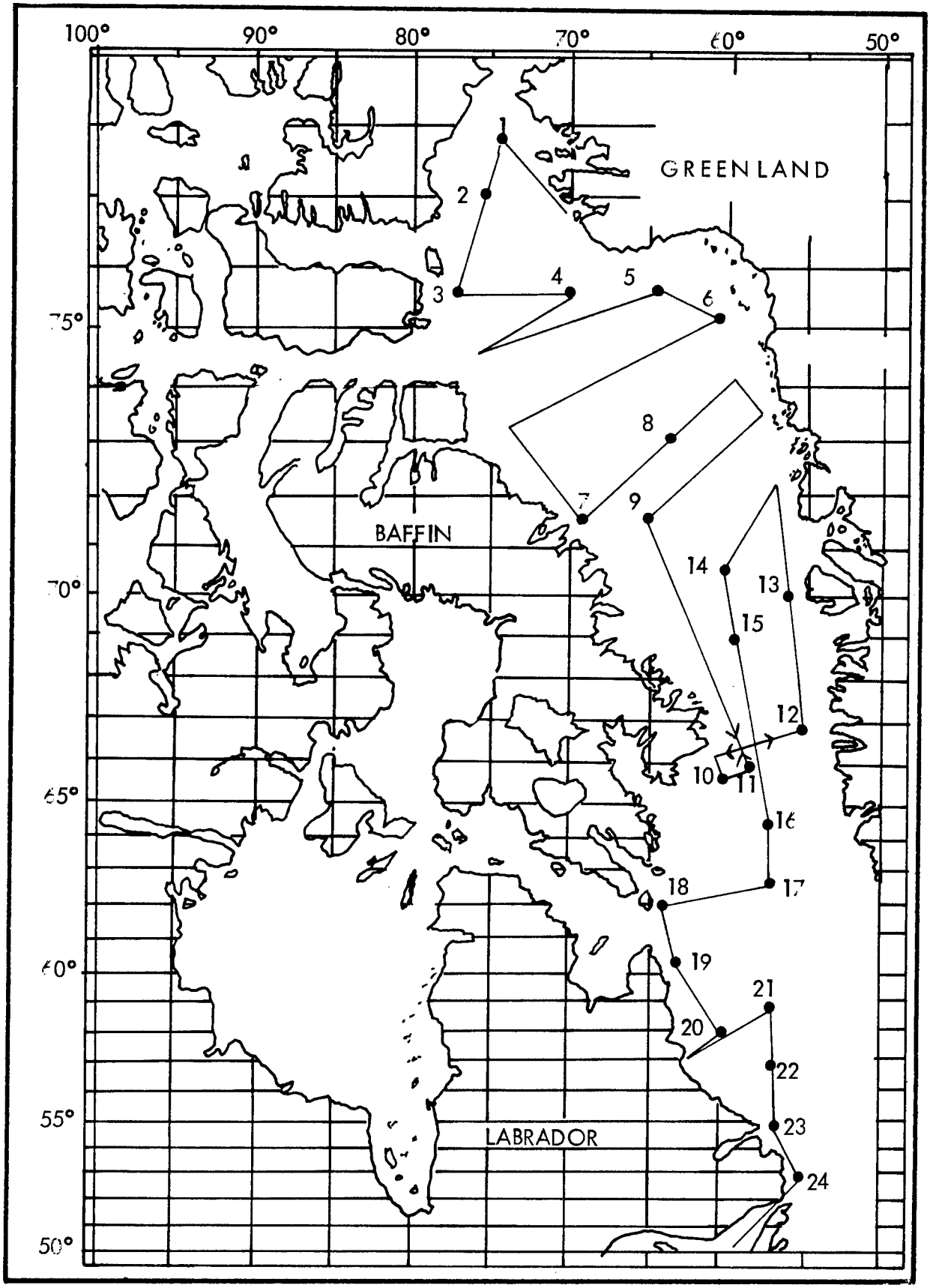

FIGURE 1. STATION LOCATIONS AND CRUISE TRACK OF CCGS LABRADOR

TABLE II

OCEANOGRAPHIC STATION SUMMARY

Station Number	Sonic Depth (m)	Cast Depth (m)	BT	Trace Metal	Bottom Sample	Wire Angle Indicator
1	732	700		√		once
2	400	350				once
3	366	300				once
4	539	500				once
5	686	650				once
6	471	425				once
7	1737	1700			√	twice
8	1701	1600				once
9	2323	2200	√	√		twice
10	607	450	√			once
11	803	750	√			once
12	82	75	√	√		
13	112	100	√			
14	649	600	√			once
15	1372	1350	√			twice
16	823	750	√			once
17	2360	2200	√	√		twice
18	402	375	√			once
19	430	400	√	√		once
20	237	200	√			once
21	3127	2200	√	√		twice
22	2286	2150	√			twice
23	203	175	√	√		once
24	165	150	√			once

indicator. This device was placed midway between two sampling bottles at various depths of the cast. It was equipped with messengers in the same manner as the sampling bottles. The indicated wire angle assisted in determining the accepted depth of the bottle.

3. Bathythermographs. Bathythermographs were taken at 16 stations utilizing a 270-meter mechanical BT. The resulting slides were forwarded to the Bedford Institute of Oceanography for processing.

B. Chemical Oceanography.

1. Salinity. Two salinity samples (duplicates) were drawn from each Bergen Nautik bottle. Salinity was determined on board LABRADOR with Industrial Instruments portable inductive salinometers (Model RS-7B, serials 22669 and 22466). Temperature-Salinity and Salinity-Depth profiles were constructed in the field to determine if a rerun of the duplicate sample was necessary. Random duplicates were analyzed on a routine basis. Vials of substandard sea water, prepared by NAVOCEANO, were analyzed aboard ship and again after the salinometers were returned to the laboratory. On the basis of these analysis checks, accuracy of salinity values is believed to be $\pm$.01‰.

2. Trace Metals. At selected stations, trace metal samples were collected in 6-ounce polyethylene bottles and returned to NAVOCEANO. These samples will be analyzed for zinc, iron, and manganese utilizing the atomic absorption spectrophotometric analysis outlined by Fabricand, et al., in 1962 in Geochim et Cosmoch, Acta, 26.

C. Marine Geology.

At station 7, the cast weight dragged on the bottom. The sediment clinging to the weight was placed in a plastic bottle and returned to the NAVOCEANO geological laboratory to be analyzed for sediment size and organic carbon and calcium carbonate content.

VI. DISPOSITION OF DATA

All oceanographic station data are on file at the National Oceanographic Data Center (NODC) under cruise reference number 31825. Trace metal analyses results are on file in the chemical laboratory at NAVOCEANO. Results of analyses on the bottom sediment sample are on file in the geological laboratory at NAVOCEANO.

VII. PRELIMINARY ANALYSES

Serial oceanographic data were processed during the cruise and copies of the summary sheets for each station were turned over to the Bedford Institute cruise coordinator.

Figures 2 through 5 show temperature and salinity distribution on a longitudinal section through Baffin Bay and Labrador Sea and on a cross section from Baffin Island to Greenland. Figures 2 and 3 show the penetration of Atlantic Water into the Baffin Bay Basin at station 15. Figures 4 and 5 show the Baffin Land Current water along the western side of the strait down to approximately 200 meters and Atlantic Water midway between Canada and Greenland at about 400 meters.

Typical bathythermograms are presented in Figure 6. The Baffin Bay BT at station 9, exhibits the effect of an ice field as a cold surface layer above the thermocline; Labrador Sea stations (16, 22, and 24) show a variety of surface temperatures and depths of the thermocline for different areas of the Labrador Sea. Anomalous conditions from mixing and seasonal effects are evident at stations 18 and 23.

Typical sound velocity profiles are presented in Figure 7. Surface ducts and sound channels are shown; a deep SOFAR channel is present at station 15.

The bottom sample obtained on the cast weight was described in the field as being a brownish gray to blue smooth clay with a sticky plastic consistency.

Special observations were noted during the cruise. The Bergen Nautik subsurface wire angle indicator was used successfully on 28 casts. It was simple to install on the wire and it caused no malfunctions of other instruments or delay in operation. The subsurface wire angles obtained by the instrument were useful in determining accepted depths; however, the wire direction data appear to have limited value. Its use is recommended for future oceanographic operations.

The multiple thermometer frame malfunctioned when used with the Bergen Nautik sample bottle; however, it should function satisfactorily with the standard Nansen bottle used by NAVOCEANO which is more sturdily constructed. Further evaluation should be made of this device on future surveys.

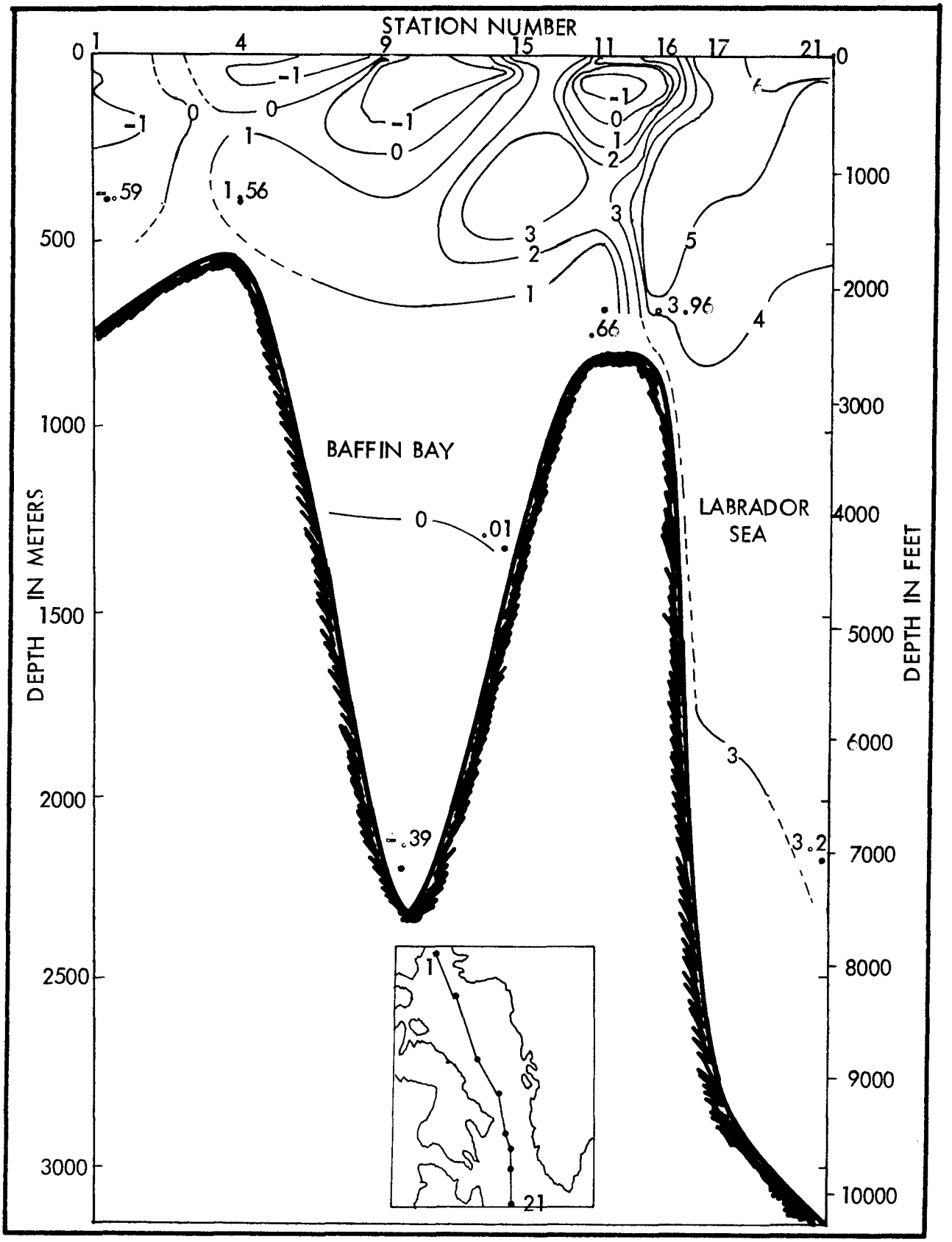

FIGURE 2. TEMPERATURE DISTRIBUTION, BAFFIN BAY - LABRADOR SEA

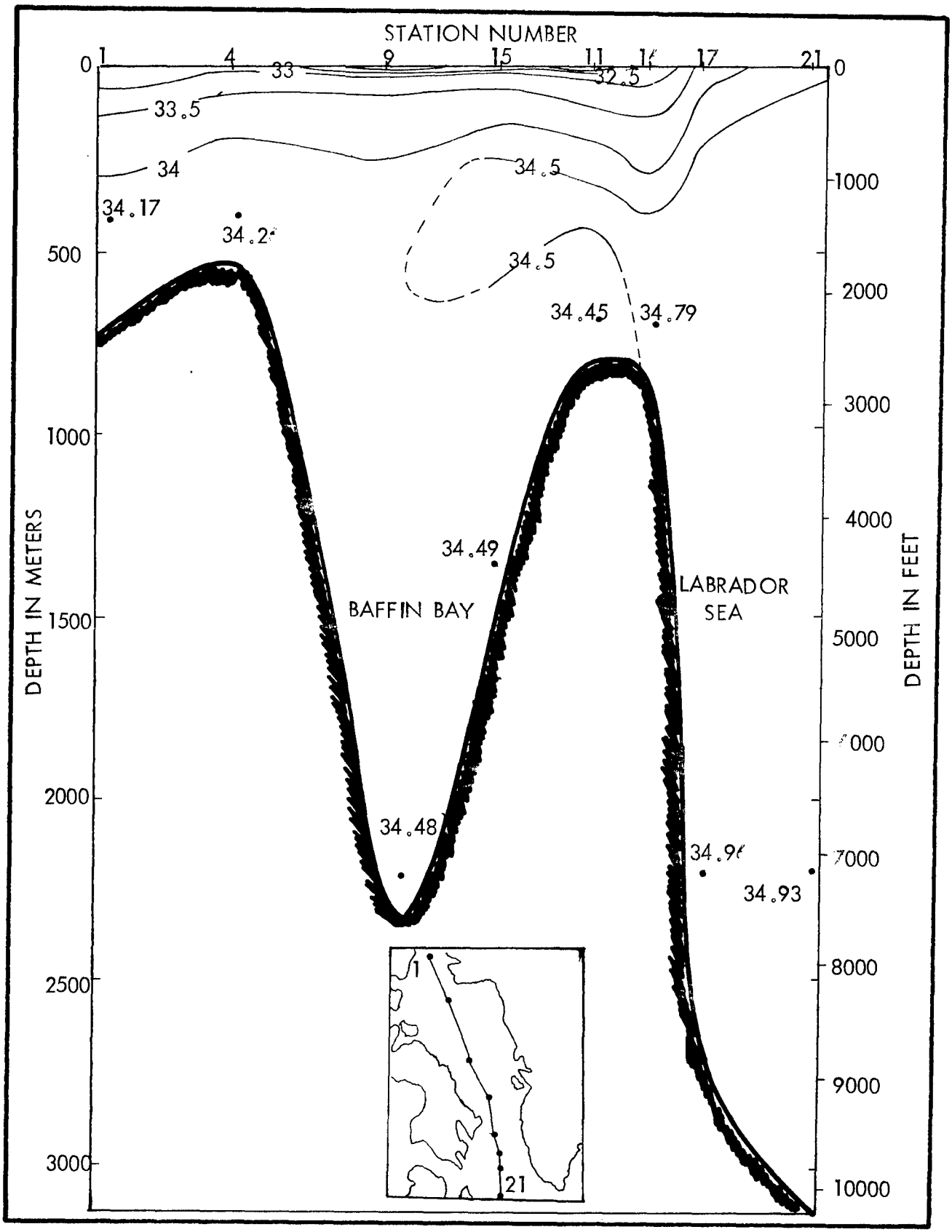

FIGURE 3. SALINITY DISTRIBUTION, BAFFIN BAY - LABRADOR SEA

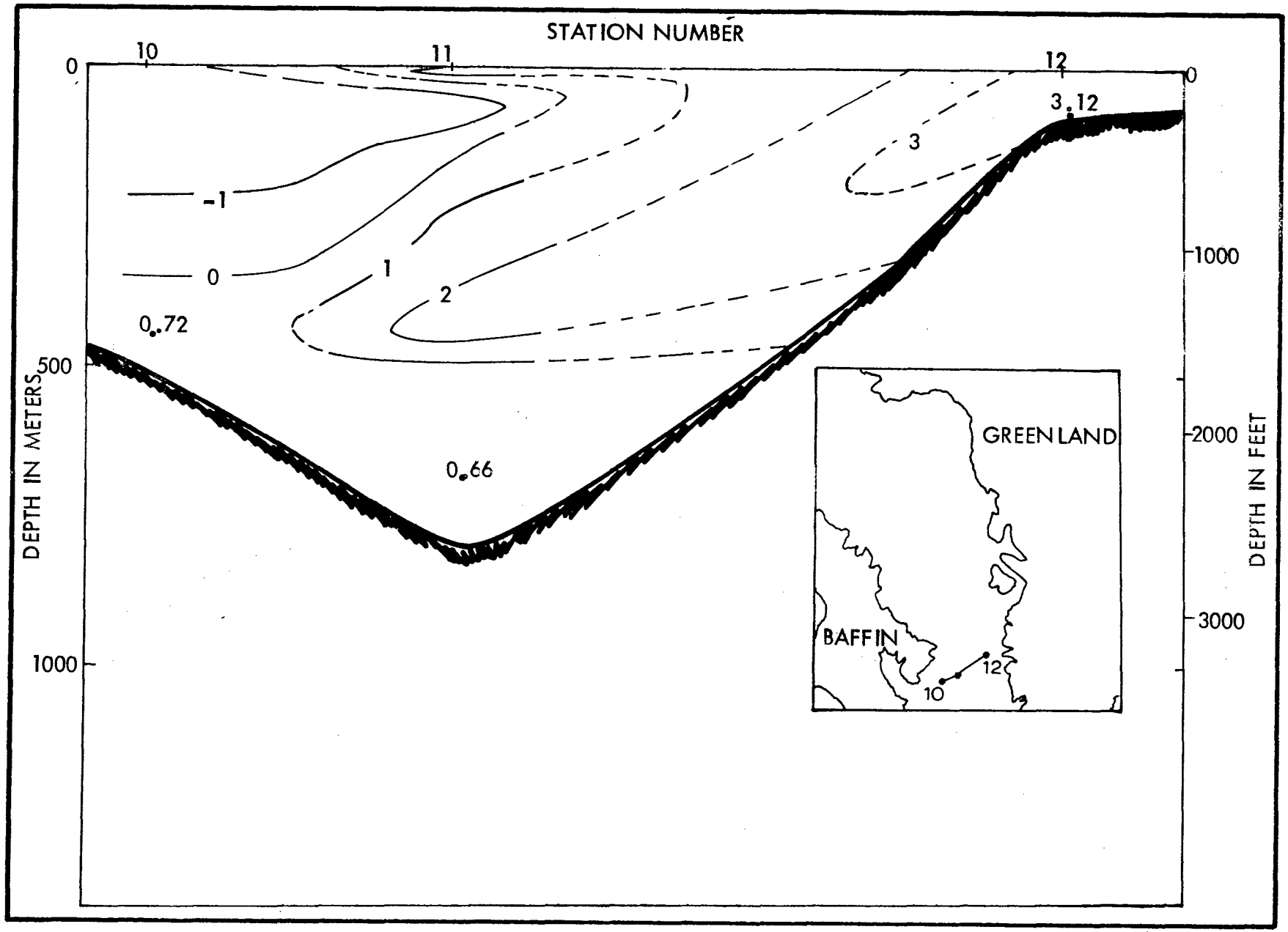

FIGURE 4. TEMPERATURE DISTRIBUTION, BAFFIN ISLAND TO GREENLAND

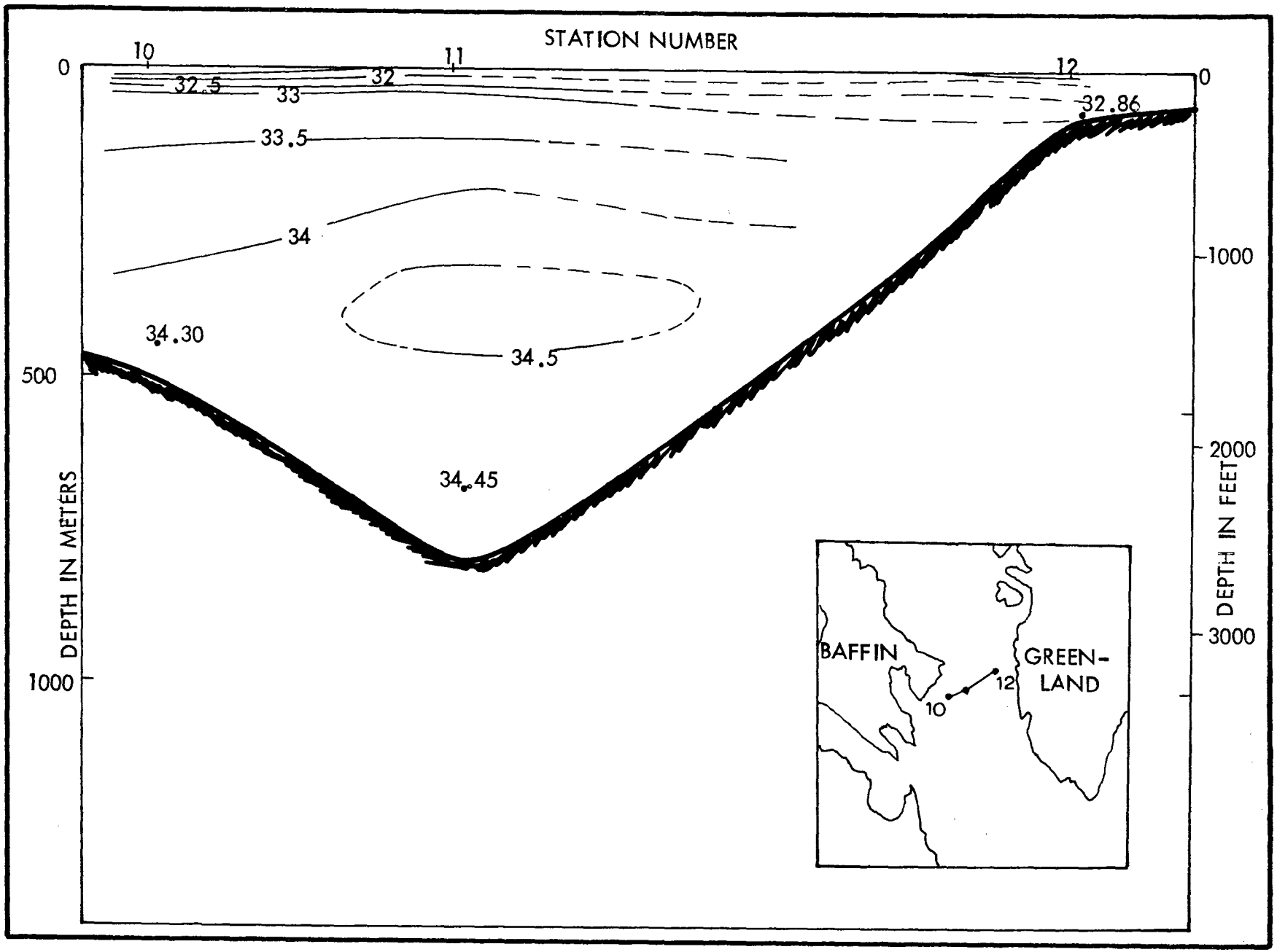

FIGURE 5. SALINITY DISTRIBUTION, BAFFIN ISLAND TO GREENLAND

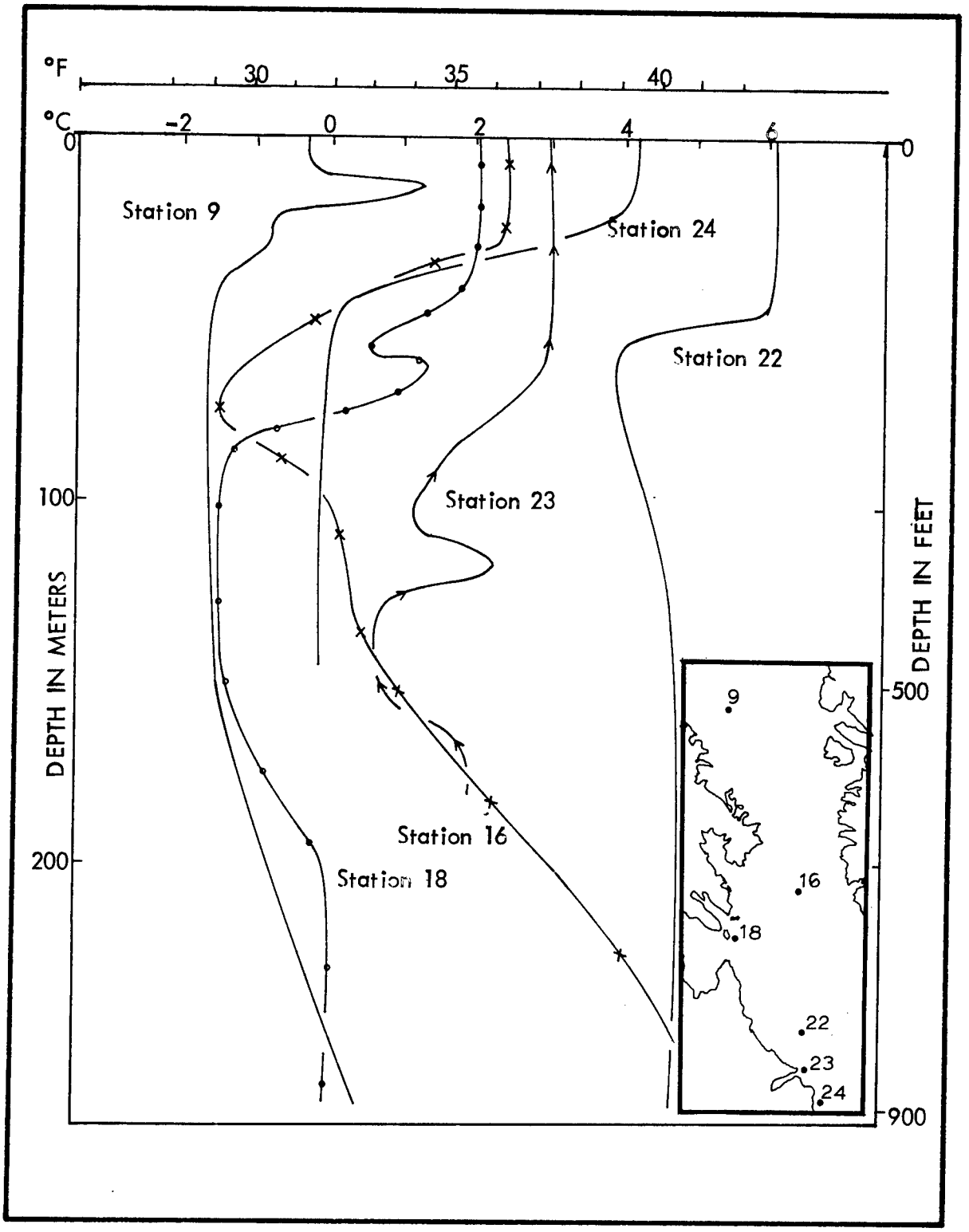

FIGURE 6. TYPICAL BATHYTHERMOGRAMS

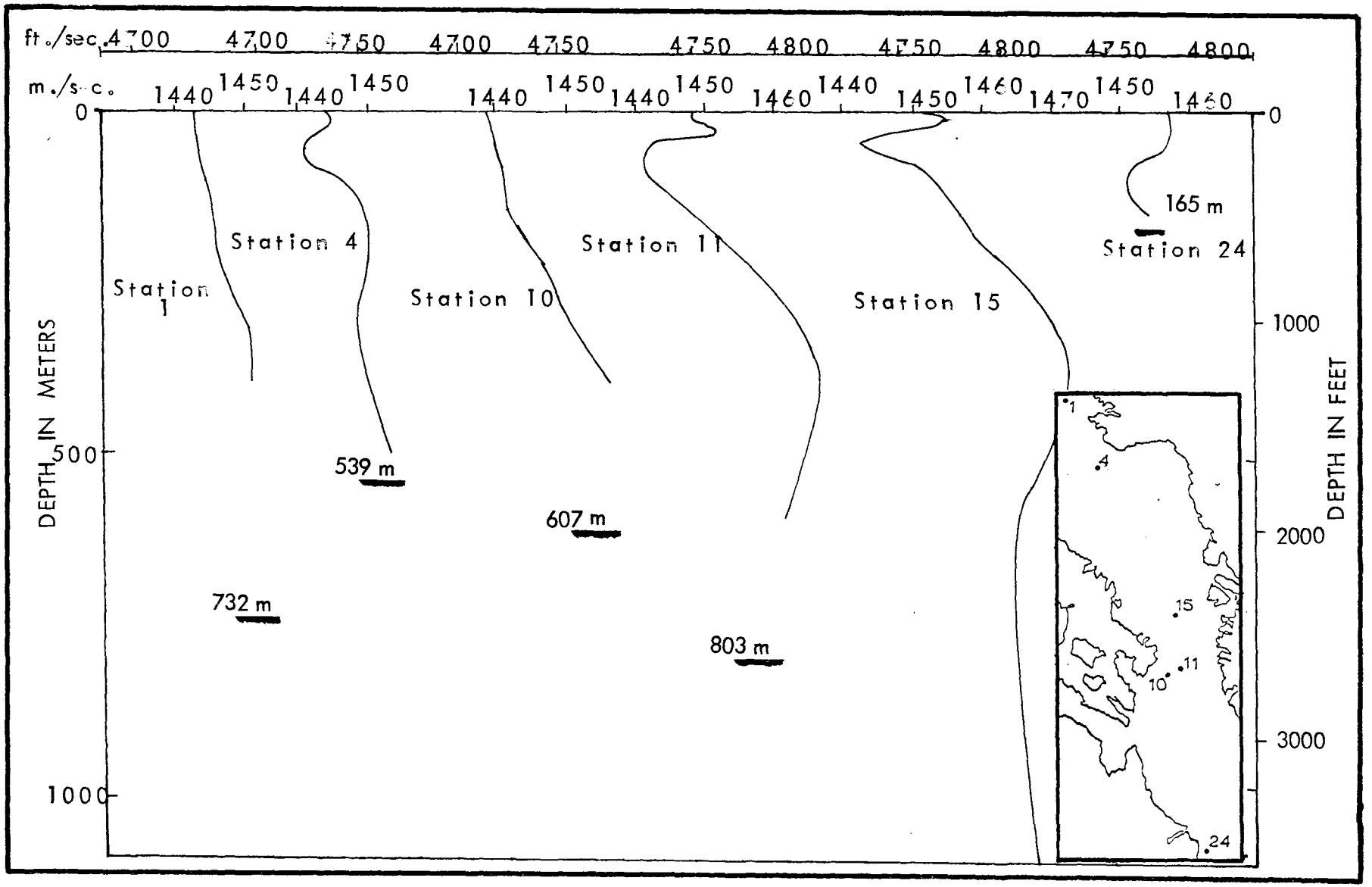

FIGURE 7. TYPICAL SOUND VELOCITY PROFILES

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